A Coal Blending Experience
for the Reduction of Power Plant SO_x Emission

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1. Introduction

Samchonpo thermal power plant consisted of 6 units, generating 3,240MW in total, drum type 560MW×4 units and supercritical once-trough type 500MW×2 units. It is one of the leading plants in KEPCO because of its high reliability and low cost. Samchonpo power plant burns about 40 kinds of coal imported from 7 countries such as United States, Australia, Indonesia and China. Since the units #1 4 were designed in late 1970s to burn bituminous coal without desulfurization facilities, any space for the future installation of FGD was not considered.

Under such circumstance, environmental requirement became gradually stringent with people's growing concern over environmental preservation. In 1999, Sox emission regulation limits were tightened from 500ppm to 270ppm. To meet emission regulation, low sulfur coal with sulfur less than 0.3% should be burned.

Since Samchonpo units 1 through 4 boilers are designed to burn only bituminous coal, the consumption of low sulfur sub-bituminous coal is preferred to be increased to reduce Sox emissions. But increasing the portion of sub-bituminous coal in the blended coal is limited by the design condition of boiler. In burning high volatile high moisture blended coal in these boilers, we were faced with several new problems on the coal storage and handling, and on the variance of combustion conditions.

2. Circumstances

2.1 Strict environment regulation

To preserve the environment from pollution caused by industrialization and improve the living condition in our country, Korean government set more stringent emission regulation than before.

Table 1. Pollution emission regulation (ppm, /s)

Yearly	Sox	Nox	Dust
By Dec. 31, '94	700	350	250
By Dec. 31, '98	500	350	100
From Jan.1, '99	**270**	350	50

2.2 Site condition

As previously cited, Samchonpo power plant had no space provision to install flue gas desulfurization(FGD) facility since the FGD facilities requires the half of the existing coal yard storage capacity. This condition thus makes it impossible for us to arrange FGD equipment.

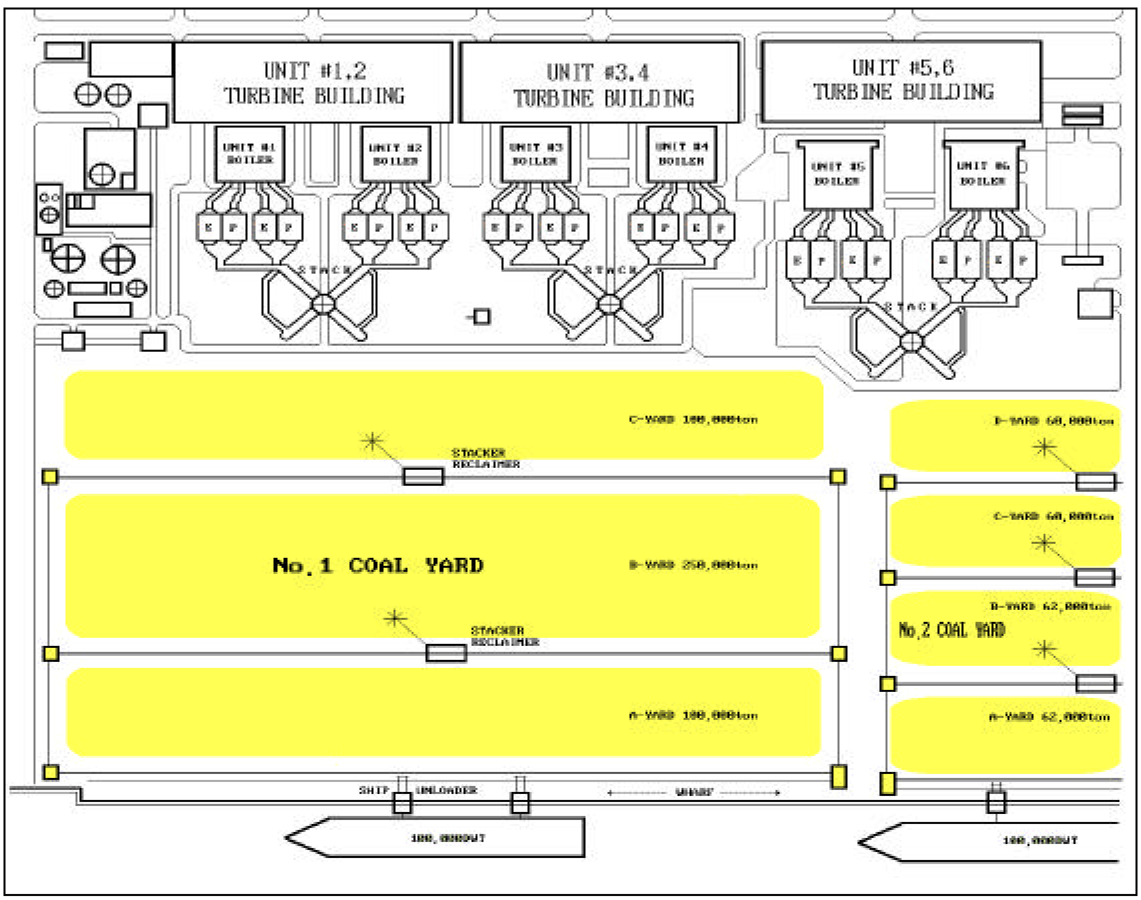

Fig. 1. Plane view of Samchonpo T/P

2.3 Meeting the situation

As it is noticed on the table 2) , Samchonpo power plant unit 1 4 were designed for bituminous coals. If only one bituminous coal is fired, SOx emission will reach up to 450ppm over the emission limits of 270ppm. So combustion of coals, blended with low sulfur sub-bituminous coal, is only a viable choice to comply with emission regulations. To apply above blended coal to existing boiler, several combustion tests had to be done to confirm the stable and economical operating conditions.

Field test and the equipment reinforcement to improve the combustion of the blended coal were preceded as follows:

- o Preparation for blended coal firing.
  - - Selection of suitable coal
  - - Combustion test
  - - Establish optimum operating condition.
- o Equipment improvement
  - - Fire extinguishing facilities
  - - Coal blending facilities
  - - Pulverized performance
- o Improvement in plant operating management
  - - Database for imported coal
  - - Optimization of coal blending ratio
  - - Installation of automatic unburned carbon analyzer
  - - Utilization of coal yard
  - - Protection of pulverizer explosion

3. Preparation for blending and coal firing

3.1 Selection of suitable coal

It has been programmed to consume low sulfur sub-bituminous coal through mixing it with bituminous coal and burn this blended coal in the existing boiler.

The first step for the above plan was to set up the required properties of coal, which satisfy combustion stabilization and economically suitability.

3.1.1 Required properties of blended coal

- o Sulfur content : below 0.32%
- o Combustibility index : over 3,500,
- o Theoretically unburned carbon : below 4.5%
- o Slagging Index (B/A) : below 0.5, Fouling Index (Rf) : below 0.2
- o Higher heating values : over 5,800 kcal/kg
- o Total moisture : below 16%
- o Hard grove grindability index : over 45

Among the 40 kinds of imported coals, we select 6 different kinds of sub-bituminous coal and 12 different kinds of bituminous coals.

Table 2. Boiler specification of Samchonpo T/P [1]

ITEM (at Boiler MCR)		1,2 Units		3,4 Units	
Continuous rating (ton/h)		1,796		1,796	
Heat release rate (/h)		86,322		86,322	
Furnace	Width/Depth (m)	18.160/15.416		18.160/15.416	
	Height (m)	54.2		54.2	
Coal burner type		Standard Coal Nozzle		Low Nox Concentric Firing	
Pulverizer	Capacity	48,534 (/h/Mill)		43,096 (/h/Mill)	
	HGI	48		48	
	Moisture (%)	10		10	
	Number per unit	6		6	
Coal Proximate Analysis		Design	Limit of range	Design	Limit of range
	TM (%)	10	Max 15	10	Max 15
	VM (%)	28	22 36	28	22 36
	FC (%)	52	50 60	52	50 60
	ASH (%)	15	Max 17	15	Max 17
	HHV (/kg)	6,080	-	6,080	-
S/H Outlet Steam	Temp ( )	540.6		541	
	Pr (/)	177.8		177.8	
R/H Outlet Steam	Temp ( )	540.6		541	
	Pr (/)	37.7		37.8	

3.1.2 Characteristics of sub-bituminous coal

The characteristics of sub-bituminous coal are far beyond those of the existing boiler design coal.

·Total moisture : greater by 70 150% ·Volatile matter : greater by 28 54%
·Higher heating values : less 200 820 /

3.1.3 Bituminous coal

Bituminous coal, of whose sulfur contents are limited to less then 0.45% wt, was grouped as follows:

o BC1 (Bituminous coal group1) :

Could satisfy required properties of blended coal when it was blended with Sub-

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1) #5,6 units are excluded from discussion because it was designed to fire sub-bituminous coal.

bituminous coal which contains sulfur at the range of 0.2 0.3% wt.

o BC2 (Bituminous coal group2) :

Could be satisfy required properties of blended coal when it was blended with Sub-bituminous coal which contains sulfur less than 0.2% wt.

Table 3. Analyses of sub-bituminous coal

Component	unit	Design Coal	Sub-bituminous coals					
			SB-11	SB-12	SB-13	SB-14	SB-15	SB-16
Total moisture	%wt	**10**	20.2	24.9	18.8	18.2	17.5	10.3
Volatile		**28**	38.0	42.1	44.8	29.3	42.7	33.5
Fixed carbon		**52**	39.9	40.5	42.3	57.9	44.1	45.9
Ash		**15**	1.96	1.2	3.2	7.2	3.2	10.4
Sulfur		**0.7**	0.10	0.10	0.22	0.25	0.25	0.25
Calorific Value	/	**6,080**	5,464	5,216	5,759	5,846	5,725	5,924
HGI	-	**48**	52	50	45	60	45	49
Ash fusion temp		**1,250**	1,270	1,228	1,260	1,544	1,210	1,270

Table 4. Analyses of bituminous coal

Component	Bituminous coals											
	BC-11	BC-12	BC-13	BC-14	BC-15	BC-16	BC-21	BC-22	BC-23	BC-24	BC-25	BC-26
Total moisture(%wt)	9.4	10.2	8.3	7.1	7.0	9.4	10.5	9.5	8.0	10.6	10.4	9.8
Volatile(%wt)	32.1	32.8	27.2	29.4	26.2	27.5	33.6	22.1	26.2	30.5	33.4	38.0
Fixed carbon (%wt)	50.9	52.3	54.7	54.0	57.4	57.2	51.5	54.7	57.3	57.4	52.0	51.6
Ash(%wt)	14.6	12.1	14.3	13.7	14.1	15.3	11.4	14.6	14.1	8.4	11.9	13.8
Sulfur(%wt)	0.35	0.36	0.36	0.37	0.37	0.38	0.48	0.41	0.43	0.42	0.42	0.48
Calorific value(/)	6,384	6,360	6,280	6,475	6,463	6,598	6,411	6,354	5,836	6,670	6,639	6,255
HGI	55	53	59	48	52	65	54	71	77	54	55	47
Ash fusion temp( )	1,076	1,290	1,530	1,384	1,380	1,410	1,136	1,438	1,410	1,516	1,443	1,489

3.2 Combustion test

Combustion test was conducted to check the combustion status and to identify the combustible range by firing each blended coal.

Blended coals were made mixing one from sub-bituminous coal 3.1.2) and the other from bituminous coal 3.1.3) in different ratio. During the test, we varied conditions of major factors such as excess O_2 ratio, pulverized coal temperature etc, which caused tangible effects on combustion.

3.2.1 Checks for Coal Firing Mechanism

In advance of combustion test, coal-firing mechanism was checked for stable combustion.

o Coal burner nozzle tilt

·each tilt degree through up-down working

·each shear pins status

o Fuel air dampers

·the length of cylinder rod on each corner

·checked coal feeder speed at 60%, 70% , respectively

o Auxiliary air dampers

·damper cylinder rods of 12 corners (After setting the furnace/wind box ÄP in manual)

·checked furnace/wind box ÄP

o Over-fire dampers

·damper degree of each corner (After setting over-fire air damper in manual)

o Each orifice of the pulverized coal pipes

·adjustment and supposition of fire ball in furnace after checking each velocity of pulverized coal pipes

3.2.2 Pulverizer operation

A Inlet air temperature

Using low-sulfur coal with much higher moisture content, we had to raise pulverizer inlet air temperature to dry and grind it well. But the sub-bituminous coal caused a fire in the pulverizer since the ignition temperature of it was too low (250).

When the moisture content of coal exceeds 16%, the temperature of pulverizer inlet air became over 250 , with hot air damper opening over 75%.

Considering these facts, we set the moisture content of coal be within 16% or less to keep proper pulverizer outlet temperature

B Grindability

Using low sulfur coal with high moisture content, pulverizer grindability was dropped as much as 10 14% and similar to the fineness. Pulverizer power consumption was greatly increased due to the drop of grindability. There was more possibility of fire or explosion at the bottom of pulverizer because coal was staying for a long time in the under bowl of pulverizer. A keen attention was needed to run the pulverizer. Besides, periodically operating a stand-by mill, and prevent accumulated heat of coal in the pulverizer bunker are the way of protecting it from fire.

Table 5. The pulverizer inlet air temperature in relation with the contents of moisture of the coal

Content of Moisture	11 %	12 %	13 %	14 %	15 %	16 %	17 %	18 %
Pulverizer Inlet air temp( )	216	222	228	235	243	**251**	**261**	**272**
Pulverizer Outlet Coal temp( )	80	80	75	70	70	**65**	**65**	**65**
Opening of Hot air Damper (%)	60	65	65	67	70	**75**	**81**	**89**

3.2.3 Boiler operation

o High volatile content of coal caused firing in vicinity of the coal burner nozzle and overheating on the water wall tubes of burner area. This problem was solved by Increasing furnace/wind box ÄP.

o The low-sulfur coal had bad characteristics in slagging and fouling, which brought overheating on water wall tubes. Coals like, as SB-2 and SB-3, of which initial deformation temperature is especially low, were severe than the others.

o As air flow increased, the firing point moved to back-pass of boiler, consequently causing superheater steam temperature to fall and on the contrary reheater temperature to rise.

o Owing to the supply more excess air than that of the common bituminous coal, the power consumption of fans increased and dry gas loss also increased.

o As moisture of coal is increased, hydrogen combustion loss, moisture loss of coal, was increased and so much, boiler efficiency was decreased.

o Unburned carbon rate and electric resistance of ash are increased. The performance of electric precipitator and dust collecting efficiency dropped.

3.3 Establish optimum operating condition

3.3.1 General

With the performance test, we checked optimum operating conditions on each coal firing.

(1) Coal fineness

By adjusting deflector vanes of pulverizer, we obtained a range of proper coal fineness and minimized the amount of unburned carbon for various load

(2) Air flow

We attained an optimum combustion point through the variation of air flow

(3) Pulverizer discharge temperature

We checked the optimum operation temperature range of pulverizer inlet air according to the pulverizer discharge temperature and the amount of unburned carbon

(4) Variation of mill load

We checked the boiler operation status and coal-firing conditions associated with flue gas and steam temperature, after changing the pulverizer load

(5) Change of operating pulverizer in order.

We checked the boiler efficiency through flame status and the distribution of furnace temperature

(6) Coal burner nozzle tilt

We checked the variation of main steam and reheat steam temperature through changing up-down tilting degrees

(7) Furnace/wind box ÄP Test

We checked a fireball in furnace through changing the furnace/wind box ÄP

3.3.2 Optimum coal blending ratio

On the basis of combustion performance results we established an optimum coal blending ratio table. (See table 6 and appendix). We now refer to these tables to get properly blended coal. Firing performance test also shows that some kinds of coal are improper to be blended each other and burned in Samchonpo existing boiler. Those relations are described as follows.

Table 6. General description of blended coal firing result

Bituminous Coal	Sub-bituminous Coal						Remarks
	SB-1	SB-2	SB-3	SB-4	SB-5	SB-6	
BC-11							: Proper
BC-12							
BC-13							
BC-14							
BC-15					×		
BC-16			×	×	×		
BC-21			×	×	×		
BC-22			×	×	×	×	
BC-23							
BC-24							

BC-25							
BC-26							

4. Equipment improvement

4.1 Fire protecting facilities of coal handling system

As we burned the high volatile coal, the possibility of fire in various coal handling equipment especially in pulverizer became greater than before. The fire-extinguishing facilities were thus greatly reinforced to ensure reliable operation and to protect equipment from damage.

- Installation of thermocouples and temperature recorder for supervision of coal silo, pulverizer and coal pipe etc from main control room
- Providing the prompt extinguishing control activity from main control room whenever supervisory instruments such as pulverizer outlet temperature monitor detect abnormal high temperature
- Upgrading CO_2 supply facilities
  ·System improved from 4ton(bottle type) to 20ton (vessel type).
  ·Automatic CO_2 injection temperature is lowered from 200 to 120 .
  ·Pulverizer forced-shutdown logic was adjusted to stop when the outlet temperature reached 93 and above.
- Others
  ·Installation of smoke detector at coal tripper room
  ·Installation of anti-explosion type lamps and switches
  ·Water spray system at coal yard

4.2 Coal-blending facility

Originally there was no coal blending facilities at #1 coal yard, which is shared with unit #1 through #4. Before we installed a coal blending facility, the blending ratio must have been a rough estimate because two reclaimers with two chains of conveyor line had done blending. Coal was blended at vibrating screen house and the blending ratio depended on only reclaiming ratio of each reclaimer operator. So it was impossible to keep coal-blending ratio constantly and the environmental regulations could not often be met.

At the beginning stage we had planed to construct a modern coal blending facility. After several times of review and discussions we finally decided to use existing screen house hoppers with addition of blending control devices.

The newly built coal blending facility is mainly composed of the VVVF speed control devices, a coal-weighing device under the coal blending feeder, and a programmable logic controller.

The coal-weighing device calculates the flow rate of each feeder coal-blending feeder and sends the data to the PLC, while PLC controls the speed of coal blending through the VVVF after processing all the input data including pre-set blending ratio requirements.

Blending bin's level signal is transferred to reclaimer cockpit so as for the operator to properly decide the reclaiming rate.

Through the above improvement, we are now able to blend coal precisely.

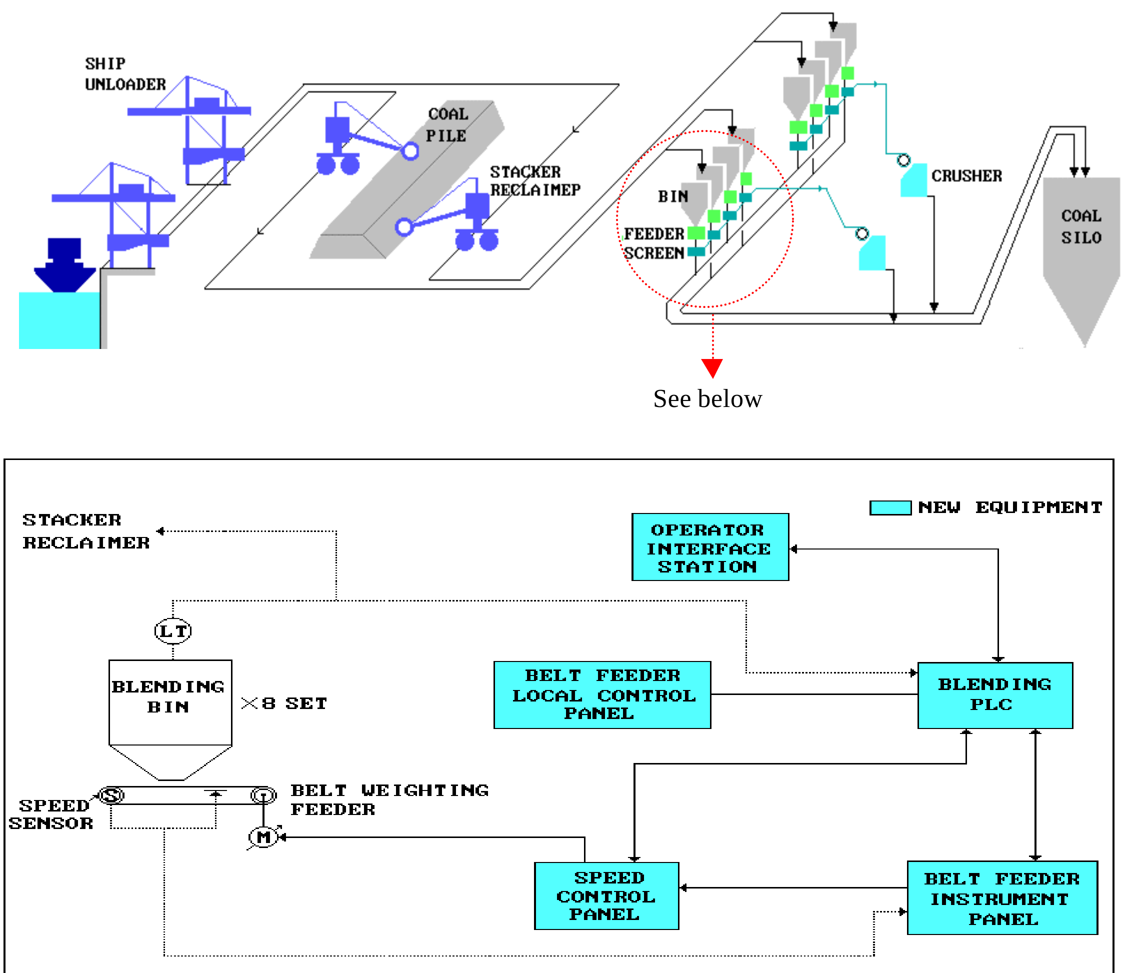


Fig. 2. Improvement on coal blending equipment

4.3 Improvement of pulverizer performance

We replaced static type classifier with dynamic one, as a solution of the problems such as reduced pulverizing rate and low fineness associated with grinding low sulfur, high moisture coal. In results, pulverizer capability increased from 40ton/hr to 49.5ton/hr per unit, and mean fineness also improved from 75% to 89%.

4.3.1 Reduction of the amount of unburned carbon in ash

The improvement of pulverizing effects of pulverizer through the replacement of classifier brought the mitigation of unburned carbon in ash from 5.65% to 3.59%.

This made improvement of plant efficiency by 0.12% and resulted in saving fuel costs by $1.23 million a year per unit.

Table 7. Finesses of pulverized coal *vs* unburned carbon in ash

Statue	Fineness (%) Based on 200mesh	Amount of unburned carbon (%)		
		Fly ash	Bottom ash	Total
Before	73.4	5.71	5.41	5.65
After	82.6	3.82	2.69	3.59
Result	9.2	1.89	2.72	2.06

5. Improvement of plant operation management

5.1 A database system for imported coal

We constructed a database system for imported coal, which provides all necessary data of coal

- o provides data to choose the kinds of coal to be blended and to decide the blending ratio according to the properties of coals
- o manages the inventory of coal and coal storing plan
- o plans coal importing

5.2 Installation of the automatic unburned carbon analyzer

To check the amount of unburned carbon in fly ash by manually and then timely notify the operator is a hard job since it takes more than 24 hours. It means that the operator cannot make timely corrections in operations. In 1995, we installed the automatic unburned carbon analyzer to solve the problems. These analyzers tests every 5 minutes and notify the operator of the amount of unburned carbon in fly ash.

5.3 Utilization plan of coal yard equipment

5.3.1 Prevention of spontaneous combustion

Spontaneous combustion was observed in a following manner; if high volatile coal is stacked longer than 21 days, the internal temperature reaches to 80 , and then the temperature rises rapidly to 100 , and leads to spontaneous combustion. To prevent spontaneous combustion we've taken measures as below:

Table 8. Measures to be taken according to the pile coal temperature

Step	Pile Temp	Measures
1st	60 70	·increase check point to 24 from 12 of each pile ·more frequently check (1 2 times a day) ·compress the surface coal with dozers ·reclaim and use earlier than others
2nd	70 90	·reclaim the coal foremost and then compress the cut surface concentrically ·if necessary, watering
3rd	90	·transfer to the other place and cool down by watering ·In case of rapid combustion by exposure of high temperature parts, suffocation extinguishments by cover the surface with other coal and compress ·start to reclaim if the temperature cooled down

5.3.2 Sectional stack of coal

We've handled the variety of coals as follows:

o According to the kinds of coal, stack the coal in a separate pile district.

o Limit the height of coal pile from 16m to 10m.

o Stack the coal with slow slop and compress the coal to prevent air infiltration.

5.4 Protection of pulverizer explosion

Statistically pulverizer fire or explosion occurs mostly at starting time and rarely some time after emergency stop. The causes of fire are the existing combustible gas and the coal dust reaching explosion temperature range. In this case, some potential kindling particles or metal frictions can make fire or explosion. We do keep the following anti-explosion operational measures:

5.4.1 In case pulverizer purge to boiler is available

o Keep 4 pulverizer outlet coal-air valves opened.

o Keep pulverizer inlet cold air gate opened.

o Keep pulverizer inlet hot air gate and damper closed.

o 5% crack open system of pulverizer inlet cold air damper

By keeping 5% crack open, cold air amounting to 71.2 /min can flow to purge and cool down the pulverizer and the burner.

5.4.2 In case boiler is tripped and fan cannot operate

o Close pulverizer inlet cold air gate.

o Close 4 pulverizer outlet coal-air valves.

o Close seal air valve for pulverizer and feeder.

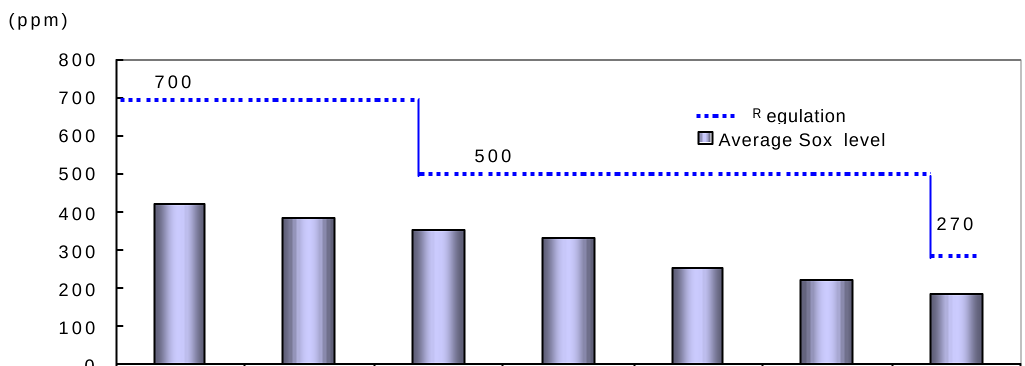
o Close tramp iron valve of pyrites hopper.

o Inject CO_2 gas continuously(pulverizer bowl temp 120)

o As soon as the temperature inside pulverizer falls to atmospheric one, stop gas supplying and clean all the remaining coal in the pulverizer

6. Conclusion

Our efforts to develop management programs associated with high volatile and low sulfur coal combustion results in SOx emission maintained ranging from 121ppm to 232ppm on a daily average, meeting the regulation limits of 270ppm.



	'93	'94	'95	'96	'97	'98	'99
Regulation	700	700	500	500	500	500	270
Average Sox level	421	385	356	334	253	221	187

* Jan. ~ Jun. '99 mean value

Dia. 1 Level of SOx emission from Samchonpo T/P

Generally, sulfur contained in coal is to be emitted after gasified through burning. So without the installation of flue gas desulfurization facility there is no method to reduce emissions of sulfur pollutants. Finally, It should be noted that although our existing boiler is designed for only bituminous coal, we have exerted to apply successfully sub-bituminous coal. As a result sulfur emissions have been reduced far below the regulation limits. This experience and strategies can be applied fairly to many other utilities bearing same burden with us.

Still, for the preparation of tightening up the emission regulations, we will continue to think out methods of minimizing pollutant emission.

Appendix **Blending ratio tables**

1. SB-1 Coal

No	Kind of Coal	Available Blending Ratio	SOx Range	Specific Properties of Blending
1	BC-11	20 60%	137 220	O Proper
2	BC-12	20 60%	153 224	O Proper
3	BC-13	20 60%	138 221	O Slightly increase amount of unburned carbon O Low Nox level o High precipitation rate
4	BC-14	20 60%	143 228	O Proper
5	BC-15	30 60%	154 225	O Increase amount of unburned carbon O Low Nox level o High precipitation rate
6	BC-16	30 60%	169 232	O Generally proper
7	BC-21	30 60%	184 239	O Generally proper
8	BC-22	40 60%	189 236	O Good combustibility o High SOx level
9	BC-23	20 60%	158 237	o Slightly increase amount of unburned carbon
10	BC-24	30 60%	160 220	o Slightly increase amount of unburned carbon and NOx level
11	BC-25	30 60%	169 220	o Improper to test
12	BC-26	30 60%	194 248	o Slightly increase amount of unburned carbon

2. SB-2 Coal

No	Kind of Coal	Available Blending Ratio	SOx Range	Specific Properties of Blending
1	BC-11	20 50%	162 219	o High fouling deposition rate
2	BC-12	20 40%	185 222	o High fouling and Slagging deposition rate o Improper to increase blending ratio by up to 50%
3	BC-13	20 40%	183 219	o High fouling and Slagging deposition rate o Improper to increase blending ratio by up to 50% o Slightly increase amount of unburned carbon
4	BC-14	20 40%	189 227	o High fouling and Slagging deposition rate o Improper to increase blending ratio by up to 50%
5	BC-15	30 40%	202 222	o High fouling and Slagging deposition rate o Improper to increase blending ratio by up to 50% o Increase amount of unburned carbon
6	BC-16	30 40%	208 230	o High fouling and Slagging deposition rate o Improper to increase blending ratio by up to 50% o Slightly increase amount of unburned carbon
7	BC-21	40%	214	o High fouling and Slagging deposition rate o Improper to increase blending ratio by up to 50% o Slightly increase amount of unburned carbon
8	BC-22	40%	233	o High fouling and Slagging deposition rate o Improper to increase blending ratio by up to 50% o Slightly increase amount of unburned carbon
9	BC-23	30 40%	195 215	o High fouling deposition rate o Improper to increase blending ratio by up to 50% o Increase amount of unburned carbon
10	BC-24	30%	208	o High fouling and Slagging deposition rate o Improper to increase blending ratio by up to 30% o Increase amount of unburned carbon
11	BC-25	30%	218	o High fouling and Slagging deposition rate o Improper to increase blending ratio by up to 30% o Increase amount of unburned carbon
12	BC-26	30 40%	189 203	o High fouling and Slagging deposition rate o Bad combustibility and Increase amount of unburned carbon

3. SB-3 Coal

No	Kind of Coal	Available Blending Ratio	SOx Range	Specific Properties of Blending
1	BC-11	40 50%	212 221	o Slightly high Slagging deposition rate
2	BC-12	50%	214	o High fouling and Slagging deposition rate o Low Nox and dust level
3	BC-13	50%	213	o High fouling and Slagging deposition rate o Slightly increase amount of unburned carbon
4	BC-14	50%	217	o High fouling and Slagging deposition rate
5	BC-15	50%	228	o High fouling and Slagging deposition rate o Slightly increase amount of unburned carbon o Need for accurate blending coal
6	BC-16	-	-	o Improper blending coal firing
7	BC-21	-	-	o Improper blending coal firing
8	BC-22	-	-	o Improper blending coal firing
9	BC-23	50%	223	o High Slagging deposition rate o Slightly increase amount of unburned carbon
10	BC-24	50%	225	o High Slagging deposition rate o Slightly increase amount of unburned carbon
11	BC-25	50%	225	o High fouling and Slagging deposition rate o Improper blending coal firing
12	BC-26	50%	256	o High fouling and Slagging deposition rate o Increase amount of unburned carbon

4. SB-4 Coal

No	Kind of Coal	Available Blending Ratio	SOx Range	Specific Properties of Blending
1	BC-11	40 60%	187 221	o Increase amount of unburned carbon o Bad combustibility o Slightly low precipitation rate
2	BC-12	40 60%	189 223	o Increase amount of unburned carbon o Bad combustibility o Slightly low precipitation rate
3	BC-13	40 60%	182 221	o Bad combustibility o Low precipitation rate o Increase amount of unburned carbon
4	BC-14	40 60%	185 226	o Slightly increase amount of unburned carbon o Low precipitation rate
5	BC-15	50%	227	o Increase amount of unburned carbon o Low precipitation rate
6	BC-16	-	-	o Improper blending coal firing
7	BC-21	-	-	o Improper blending coal firing
8	BC-22	-	-	o Improper blending coal firing
9	BC-23	50%	222	o Bad combustibility o Low precipitation rate
10	BC-24	50%	224	o Increase amount of unburned carbon o Low precipitation rate
11	BC-25	50%	224	o Increase amount of unburned carbon o Improper to test
12	BC-26	40 50%	217 227	o Bad combustibility o Increase amount of unburned carbon o Low precipitation rate

5. SB-5 Coal

No	Kind of Coal	Available Blending Ratio	SOx Range	Specific Properties of Blending
1	BC-11	40 60%	184 215	o Proper
2	BC-12	50%	210	o High fouling deposition rate
3	BC-13	50%	208	o Slightly increase amount of unburned carbon o Slightly high fouling and Slagging deposition rate
4	BC-14	50%	218	o High fouling deposition rate
5	BC-15	-	-	o Improper blending coal firing
6	BC-16	-	-	o Improper blending coal firing
7	BC-21	-	-	o Improper blending coal firing
8	BC-22	-	-	o Improper blending coal firing
9	BC-23	50%	218	o Slightly high fouling deposition rate o Slightly Increase amount of unburned carbon
10	BC-24	50%	223	o Slightly high fouling deposition rate o Slightly Increase amount of unburned carbon
11	BC-25	50%	218	o Slightly high fouling deposition rate o Improper to test
12	BC-26	50%	213	o Slightly Increase amount of unburned carbon o Slightly high fouling deposition rate

6. SB-6 Coal

No	Kind of Coal	Available Blending Ratio	SOx Range	Specific Properties of Blending
1	BC-11	40% up to	162 229	o Possible to increase of blending ratio
2	BC-12	50% up to	158 225	o Possible to increase of blending ratio
3	BC-13	40% up to	169 229	o Possible to increase of blending ratio
4	BC-14	50% up to	151 227	o Possible to increase of blending ratio
5	BC-15	70% up to	188 228	o If increase the blending ratio by 70%, It is possible to keep emission regulation
6	BC-16	70% up to	188 222	
7	BC-21	70% up to	188 225	
8	BC-22	-	-	o Improper blending coal firing
9	BC-23	60% up to	188 224	o If increase the blending ratio by 60%, It is possible to keep emission regulation
10	BC-24	60% up to	188 227	
11	BC-25	60% up to	188 226	
12	BC-26	50% up to	188 228	o Bad combustibility o Slightly increase amount of unburned carbon o Low precipitation rate